PERFORMANCE REPORT

As Required by

FEDERAL AID IN SPORT FISH RESTORATION ACT

TEXAS

FEDERAL AID PROJECT F-221-M-1

INLAND FISHERIES DIVISION MONITORING AND MANAGEMENT PROGRAM

2010 Survey Report

Sweetwater Reservoir

Prepared by:

Spencer Dumont, District Management Supervisor
and
Ben Neely, Assistant District Management Supervisor

Inland Fisheries Division
District 1-B, Abilene, Texas

Carter Smith
Executive Director

Gary Saul
Director, Inland Fisheries

July 31, 2011

TABLE OF CONTENTS

SURVEY AND MANAGEMENT SUMMARY

Fish populations in Sweetwater Reservoir were surveyed in 2009-2011 using electrofishing, gill nets, and trap nets. This report summarizes the results of the surveys and contains a management plan for the reservoir based on those findings.

- **Reservoir Description:** Sweetwater Reservoir is a 630-acre reservoir. It was constructed by the city of Sweetwater in 1930 to provide water for municipal and industrial purposes. Water level began dropping in 1998 and declined 38 feet over a period of nine years. In July 2007, water level increased substantially and, by fall 2008, water level was within a foot of conservation level. Habitat consisted primarily of dead brush. There was one public boat ramp, and public access was limited to the boat ramp area, a park, and a couple of other access points.

- **Management History:** A 14-to18-inch slot limit on largemouth bass was implemented on 1 September 2001. Sport and forage fishes were reintroduced in 2007 and 2008 after the reservoir nearly filled in 2007.

- **Fish Community:**
  - **Prey species:** Black bullhead, inland silversides, gizzard shad, and bluegill were all abundant and provided an excellent overall forage base.

  - **Catfishes:** Channel catfish ranged from 8-12 in long. Additional time will be required for channel catfish to become more abundant and grow to larger sizes.

  - **Largemouth bass:** Numbers and sizes of largemouth bass available to anglers were excellent in 2009 and 2010. Fish over 12 in were plump. There was a strong Florida largemouth bass influence in the population.

  - **White crappie:** The trap net sample in 2009 indicated that stocked adult fish produced at least one year class. All crappie collected in 2009 were less than 10 in long.

- **Management strategies:** Conduct creel survey in 2011/2012 to evaluate largemouth bass fishery under a 14-18 in slot limit. A watershed map will be developed to better understand landscape-level factors that affect water collection and water quality.

INTRODUCTION

This document is a summary of fisheries data collected from Sweetwater Reservoir in 2009-2011. The purpose of the document is to provide fisheries information and make management recommendations to protect and improve the sport fishery. While information on other species of fishes was collected, this report deals primarily with major sport fishes and important prey species. Historical data are presented for comparison.

Reservoir Description

Sweetwater Reservoir is a 630-acre reservoir, at conservation pool, on Bitter and Cottonwood creeks, tributaries of the Clear Fork of the Brazos River. It was constructed by the city of Sweetwater in 1930. It provided water to the city golf course located at the reservoir. It no longer serves as a municipal water supply. It is also used for recreation. It is located approximately 12 miles southeast of the city of Sweetwater.

Water level began dropping in 1998 and declined 38 feet over a period of nine years (Figure 1). In July 2007, water level increased substantially and, by fall 2008, water level was within a foot of conservation level (Figure 1). Water level has steadily declined since 2008 and was 6-8 feet below conservation pool during fish-assessment surveys. A golden algae kill occurred in March 2003 and affected species included largemouth bass, sunfish, gizzard shad, white crappie, and catfish.

Habitat at time of sampling consisted primarily of dead brush. There was one public boat ramp, and public access was limited to the boat ramp area, a park, and a couple of other access points. Other descriptive characteristics for Sweetwater Reservoir are shown in Table 1.

Management History

Previous management strategies and actions: Management strategies and actions from the previous survey report (Farooqi and Dumont 2007) included:

1. Determine status of fish community and re-introduce populations of forage and game fish through management and hatchery stockings when reservoir fills.
   Action: Reservoir was stocked with gizzard shad, inland silversides, fathead minnows, golden shiners, Florida largemouth bass (including ShareLunker largemouth bass), adult white crappie, channel catfish, and bluegill in 2007 and 2008. Fish populations were assessed with electrofishing gear in 2009 and 2010, with trap nets in 2009, and gill nets in 2011.

Harvest regulation history: A 14-to18-inch slot limit on largemouth bass was implemented on 1 September 2001. All other sport fish in Sweetwater Reservoir are currently managed with statewide regulations (Table 2).

Stocking history: Fish populations had to be re-introduced because of severe drought and golden algae kills. Recovery began in 2007 and, by the end of 2008, all major forage and sport fish had been stocked at least once. The complete stocking history since 2007 is shown in Table 3.

Vegetation/habitat history: Sweetwater Reservoir has no vegetation/habitat management history.

Water Transfer: There are currently no pumping stations on the reservoir which transfer water to other reservoirs.

METHODS

Fishes were collected by electrofishing (1.5 hour at 18 5-min stations), trap netting (2009; nine net nights at nine sites) and gill netting (five net nights at five sites). Catch per unit effort (CPUE) for electrofishing was recorded as the number of fish caught per hour (fish/h) of actual electrofishing and, for gill nets and trap nets, as the number of fish per net night (fish/nn). Microsatellite DNA analysis was used to determine largemouth bass genetic composition. All survey sites were randomly selected and all surveys were conducted according to the Fishery Assessment Procedures (TPWD, Inland Fisheries Division, unpublished manual revised 2011). Fish assessment surveys were not conducted from 2003-2008 because of extreme low-water conditions. Habitat composition was determined by assessing habitat at 27 random near-shore points and 63 random points distributed throughout the reservoir. Substrate was categorized using the Wentworth scale as soft (sand, silt, and clays), pebble (particle size < 2.5-in diameter), cobble (particle size 2.5-10-in diameter), or boulder (> 10-in diameter) (Wentworth 1922). Water level at time of habitat sampling was 6 ft. below conservation level. Presence or absence was determined for each habitat type at each point. Percent occurrence was determined for each habitat type and 95% confidence intervals were calculated with 1,000 resamples of the original data (with replacement) by the percentile method.

Sampling statistics (CPUE for various length categories), structural indices [Proportional Size Distribution (PSD), as defined by Guy et al. (2007)], and condition indices [relative weight (W_r)] were calculated for some target fishes according to Anderson and Neumann (1996). Ninety-five percent confidence intervals for relative weight were calculated with 1,000 resamples of the original data (with replacement) by the percentile method. Index of vulnerability (IOV) was calculated for gizzard shad (DiCenzo et al. 1996). Relative standard error (RSE = 100 X SE of the estimate/estimate) was calculated for all CPUE statistics and SE was calculated for structural indices and IOV. District averages were determined from 14 area reservoirs in nine counties. Source for water level data was the United States Geological Survey website (http://waterdata.usgs.gov/tx/nwis/).

RESULTS AND DISCUSSION

Habitat: Dead brush was the dominant habitat type in nearshore and offshore sites (Figures 2 and 3). Several species of aquatic vegetation were present, and the most prevalent were Illinois pondweed and stargrass (Figure 2). Substrate of nearshore sites consisted equally of clay/silt, pebble, and cobble/boulder (Figure 2).

Prey species: Electrofishing CPUE of sub-stock gizzard shad was 352.0/h in 2010, a substantial increase from 2009 (Figure 4). Gizzard shad size structure in 2010 consisted of two modes, one centered at 4 in and the other at 11 in (Figure 4). The IOV increased from 40 in 2009 to 62 in 2010, but a large increase in PSD also occurred. A historical comparison of gizzard shad indicated that relative abundance of sub-stock gizzard shad in 2010 was at the high end of what typically occurred in the reservoir prior to and during the drought years of 1997-2002 (average CPUE 236.5; range 82.0-378.5). The IOV was similar to previous years (Figure 5) and below the district average of 79. The electrofishing CPUE of bluegill was 1,187.1/h in 2009 and 563/h in 2010. Bluegill size structure consisted almost entirely of fish less than 6 in TL (Figure 6). Establishment of bluegill as a forage fish following the substantial water level increase in 2007 was successful as electrofishing catch rates in 2009 and 2010 far exceeded historical catches (Figure 7). In addition to well established gizzard shad and bluegill

populations, inland silversides and black bullhead were apparently abundant based on observations during electrofishing and trap net surveys, respectively.

Channel catfish: Gill net CPUE of channel catfish was 1.0/nn, much lower than the pre-drought 1999 CPUE (5.0/nn). Size structure of channel catfish in 2011 consisted of 8-12" fish and was considerably different than the 1999 pre-drought sample (Figure 8). The channel catfish population will require more time to increase relative abundance and improve size structure.

Largemouth bass: Electrofishing CPUE of largemouth bass was 106.4/h in 2010. Total and stock catch rates of largemouth bass declined from 2009 to 2010 (Figure 9). However, size structure improved as indicated by PSD, PSD-14, and PSD-18 (Figure 9). Relative abundance of largemouth bass $\geq$ 14 in TL was similar to pre-drought (1996-1998) and drought (1999-2002) years (Figure 10). Electrofishing CPUE of largemouth bass less than 14 in TL was less than pre-drought years but was similar to mean catch for the district (Figure 10). Proportional size distribution indices of largemouth bass in 2009 and 2010 compared favorably with indices from pre-drought years (Figure 11). Mean W_r of 8.0-11.9 in fish in 2009-2010 was lower compared to pre-drought and drought periods (Table 4). Mean W_r of 12.0-14.9 in fish was higher in 2009-2010 compared to previous years (Table 4). Mean W_r of $\geq$ 15.0 in fish was similar to the drought estimate but higher than the pre-drought estimate (Table 4). Body condition of 12 in and longer largemouth bass indicated that forage availability and vulnerability matched well with existing population of quality-sized largemouth bass. However, lower body condition of smaller largemouth bass indicated that more forage was needed or that forage wasn't readily vulnerable to that size group of largemouth bass. Genetic composition of largemouth bass was substantially altered with post-drought stockings as indicated by the large increase in Florida largemouth bass influence (Table 5).

Crappie: Trap net CPUE of white crappie was 7.1/nn in 2009. Prior to elimination of white crappie through drought and golden algae, trap net catch rates of white crappie were 2.6/nn and 5.0/nn in 1999 and 2002, respectively (Figure 12). The trap net sample in 2009 indicated that stocked adult fish produced at least one year class since the 2007 stocking (Figure 12).

Fisheries management plan for Sweetwater Reservoir, Texas

Prepared – July 2011.

ISSUE 1: Largemouth bass have become established and are providing a growing fishery under a 14-18 in slot limit. Determination of angler oriented statistics for this fishery is necessary to evaluate the slot limit.

MANAGEMENT STRATEGIES

1. Conduct an annual access point creel survey beginning on 1 September 2011 and ending 31 August 2012.

ISSUE 2: Fish populations in Sweetwater Reservoir have been affected by dynamic water levels.

MANAGEMENT STRATEGY

1. Create watershed map for Sweetwater Reservoir and determine if watershed characteristics influence water collection and water quality in the reservoir.
2. Make watershed-level management recommendations to improve water collection in Sweetwater Reservoir.

ISSUE 3: Many invasive species threaten aquatic habitats and organisms in Texas and can adversely affect the state ecologically, environmentally, and economically. For example, zebra mussels (*Dreissena polymorpha*) can multiply rapidly and attach themselves to any available hard structure, restricting water flow in pipes, fouling swimming beaches and plugging engine cooling systems. Giant Salvinia (*Salvinia molesta*) and other invasive vegetation species can form dense mats, interfering with recreational activities like fishing, boating, skiing and swimming. The financial costs of controlling and/or eradicating these types of invasive species are significant. Additionally, the potential for invasive species to spread to other river drainages and reservoirs via watercraft and other means is a serious threat to all public waters of the state.

MANAGEMENT STRATEGIES

1. Contact and educate marina owners and controlling authority about invasive species, and provide them with posters, literature, etc. so that they can in turn educate their customers and post appropriate signage at access points around the reservoir if necessary.
2. Educate the public about invasive species through the use of media and the internet.
3. Make a speaking point about invasive species when presenting to constituent and user groups.
4. Keep track of (i.e., map) existing and future inter-basin water transfers to facilitate potential invasive species responses.

SAMPLING SCHEDULE JUSTIFICATION:

Conduct additional trap net and electrofishing surveys in fall 2012 to monitor white crappie and largemouth bass populations. A creel survey in 2011-2012, while specifically designed to determine largemouth bass fishery statistics, will also provide baseline fishery information on other species. Conduct standard trap net, electrofishing, and gill net surveys in 2014-2015.

LITERATURE CITED

Anderson, R. O., and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 *in* B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

DiCenzo, V. J., M. J. Maceina, and M. R. Stimert. 1996. Relations between reservoir trophic state and gizzard shad population characteristics in Alabama reservoirs. North American Journal of Fisheries Management 16:888-895.

Farooqi, M., and Dumont, S. 2007. Statewide freshwater fisheries monitoring and management program survey report for Sweetwater Reservoir, 2006. Texas Parks and Wildlife Department, Federal Aid Report F-30-R, Austin.

Guy, C. S., R. M. Neumann, D. W. Willis, and R. O. Anderson. 2007. Proportional size distribution (PSD): a further refinement of population size structure index terminology. Fisheries 32:348.

Wentworth, C. K. 1922. A scale of grade and class terms for clastic sediments. The Journal of Geology 30:377-392.

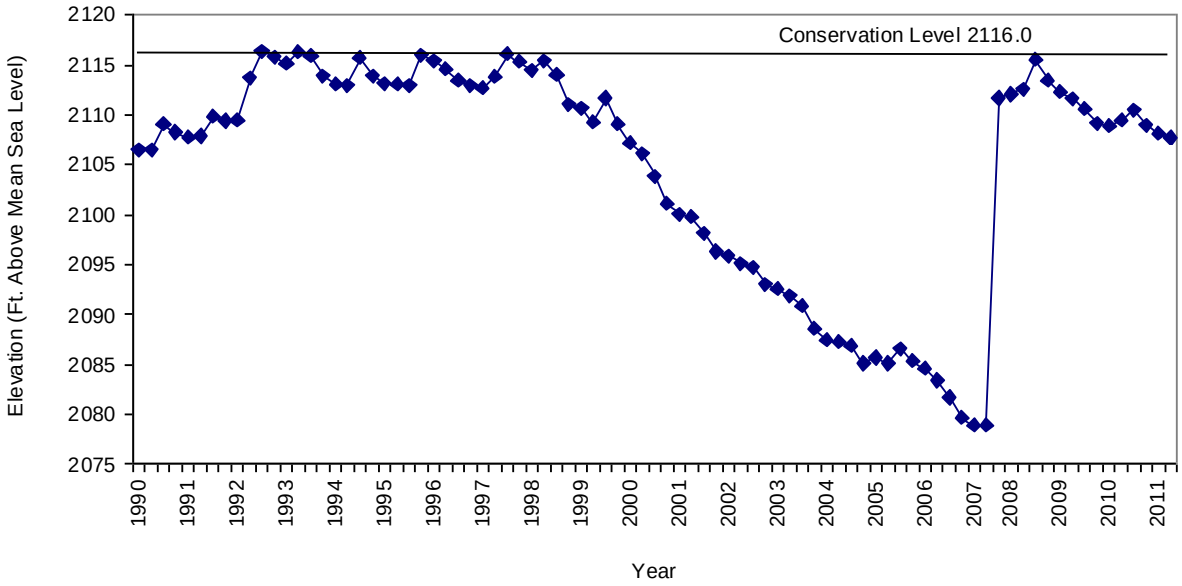


Figure 1. Quarterly water level elevations in feet above mean sea level recorded for Sweetwater Reservoir, Texas.

Table 1. Characteristics of Sweetwater Reservoir, Texas.

Characteristic	Description
Year constructed	1930
Controlling authority	City of Sweetwater
County	Nolan
Reservoir type	Tributary stream
Watershed size	66,896 acres
Reservoir-to-Watershed percentage	1.02%
Shoreline Development Index	4.62
Conductivity	979 µmhos/cm

Table 2. Harvest regulations for Sweetwater Reservoir, Texas.

Species	Bag Limit	Minimum-Maximum Length (inches)
Channel catfish	25	12 - No Limit
Catfish, flathead	5	18 - No Limit
Bass, largemouth	5	14 - 18 Slot Limit *
Crappie white	25	10 - No Limit

* Largemouth bass ≤ 14 inches and ≥ 18 inches may be harvested.

Table 3. Stocking history of Sweetwater Reservoir, Texas, beginning with drought and golden algae recovery in 2007. Size categories are: FGL (fingerling) = 1-3 inches, ADL = adult.

Species	Year	Number	Size
Fathead minnow	2007	12,500	ADL
Golden shiners	2007	1,000	ADL
Inland silversides	2008	500	ADL
Gizzard shad	2008	500	ADL
Channel catfish	2008	62,973	FGL
	2009	63,441	FGL
	Total	126,414	
Bluegill	2007	64,545	FGL
	2008	64,601	FGL
	2009	86,421	FGL
	Total	215,567	
Florida largemouth bass	2008	63,338	FGL
	2009	72,257	FGL
	Total	192,,995	
Florida largemouth bass (ShareLunker)	2008	39,970	FGL
White crappie	2007	50	ADL

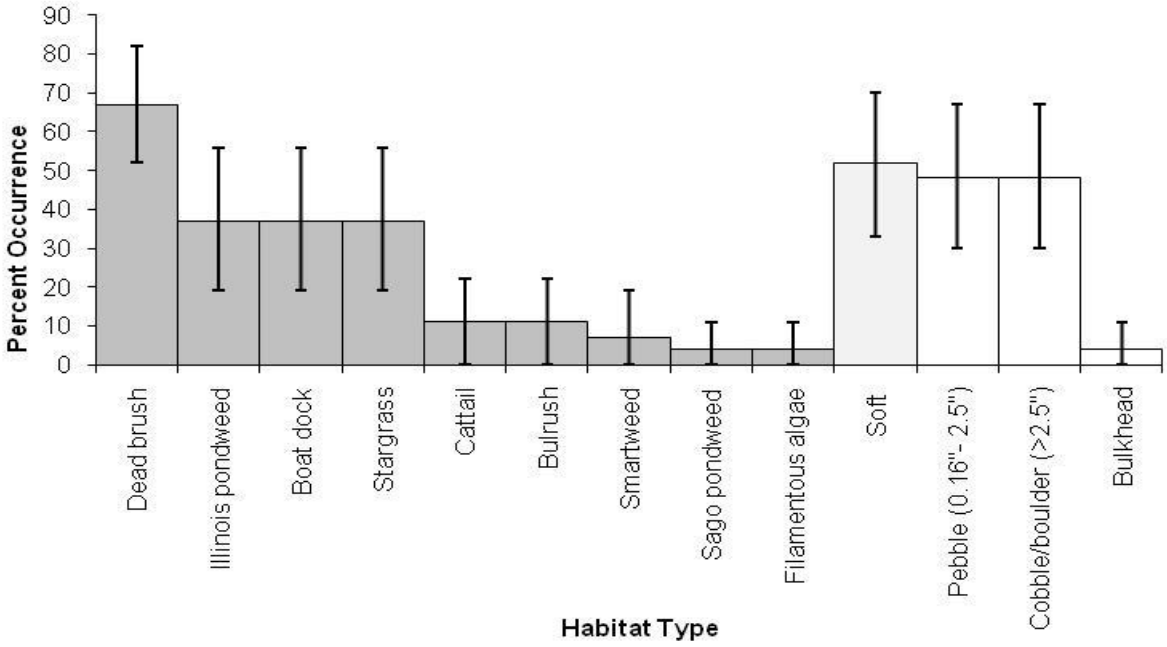


Figure 2. Percent occurrence (± 95% C.I., derived from 1,000 resamples, with replacement, of the original data; N=27) of nearshore habitat and substrate types at Sweetwater Reservoir, Texas, 2010.

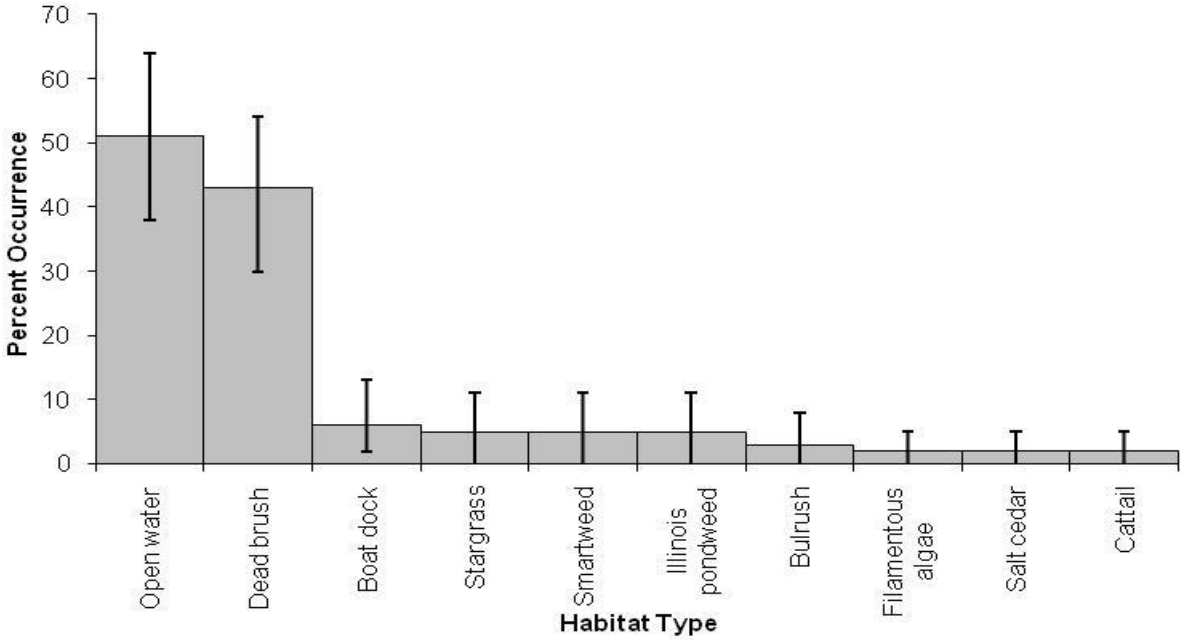
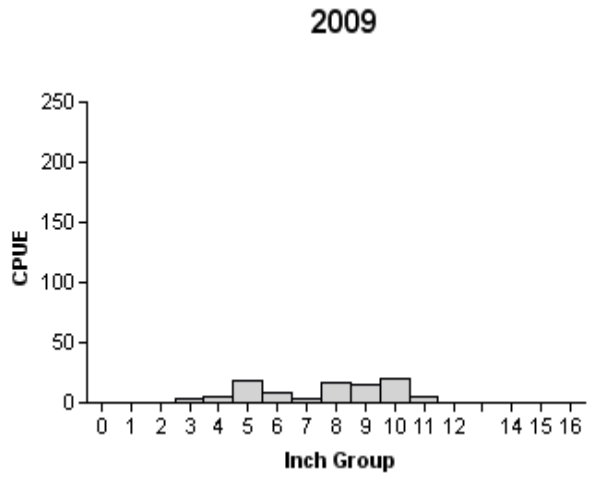
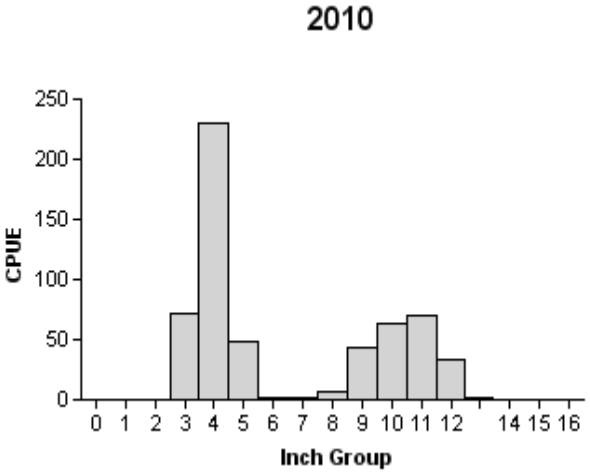


Figure 3. Percent occurrence (± 95% C.I., derived from 1,000 resamples, with replacement, of the original data; N=63) of offshore habitat at Sweetwater Reservoir, Texas, 2010.

Gizzard Shad



Effort =	1.2
Total CPUE =	94.3 (24; 110)
Stock CPUE=	60.0 (19; 70)
PSD=	7 (4)
IOV =	40 (12)



Effort =	1.0
Total CPUE =	572.0 (18; 572)
Stock CPUE=	220.0 (20; 220)
PSD=	47 (3)
IOV =	62 (7)

Figure 4. Number of gizzard shad caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for PSD and IOV are in parentheses) for fall electrofishing surveys, Sweetwater Reservoir, Texas, 2009, and 2010.

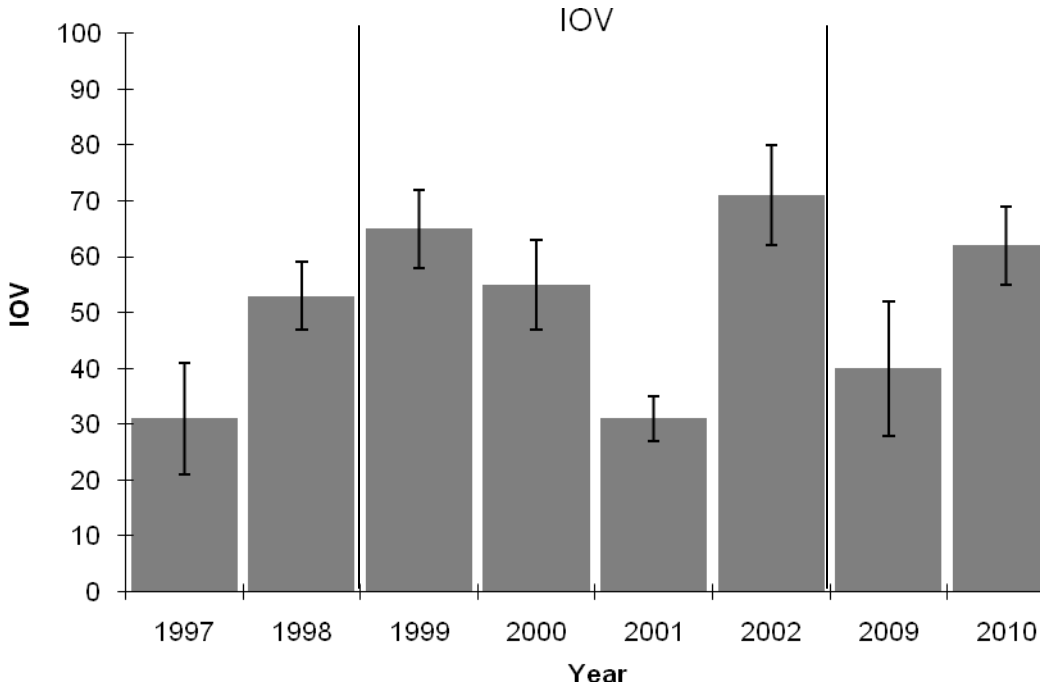


Figure 5. Index of vulnerability (IOV)(± SE) from fall electrofishing surveys, Sweetwater Reservoir, Texas, 1997-2010. Years within vertical lines represent drought period.

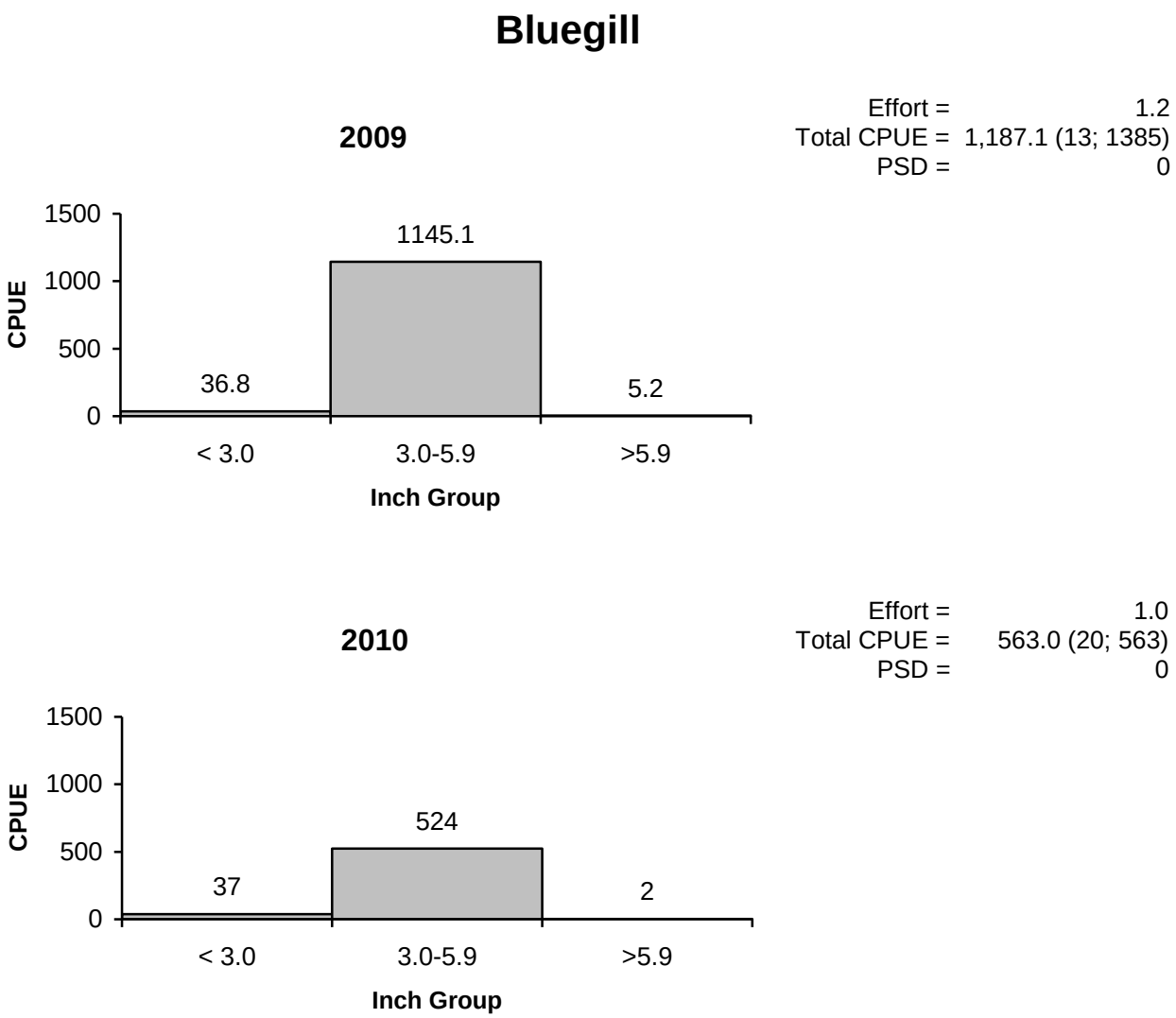


Figure 6. Number of bluegill caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Sweetwater Reservoir, Texas, 2009, and 2010.

.

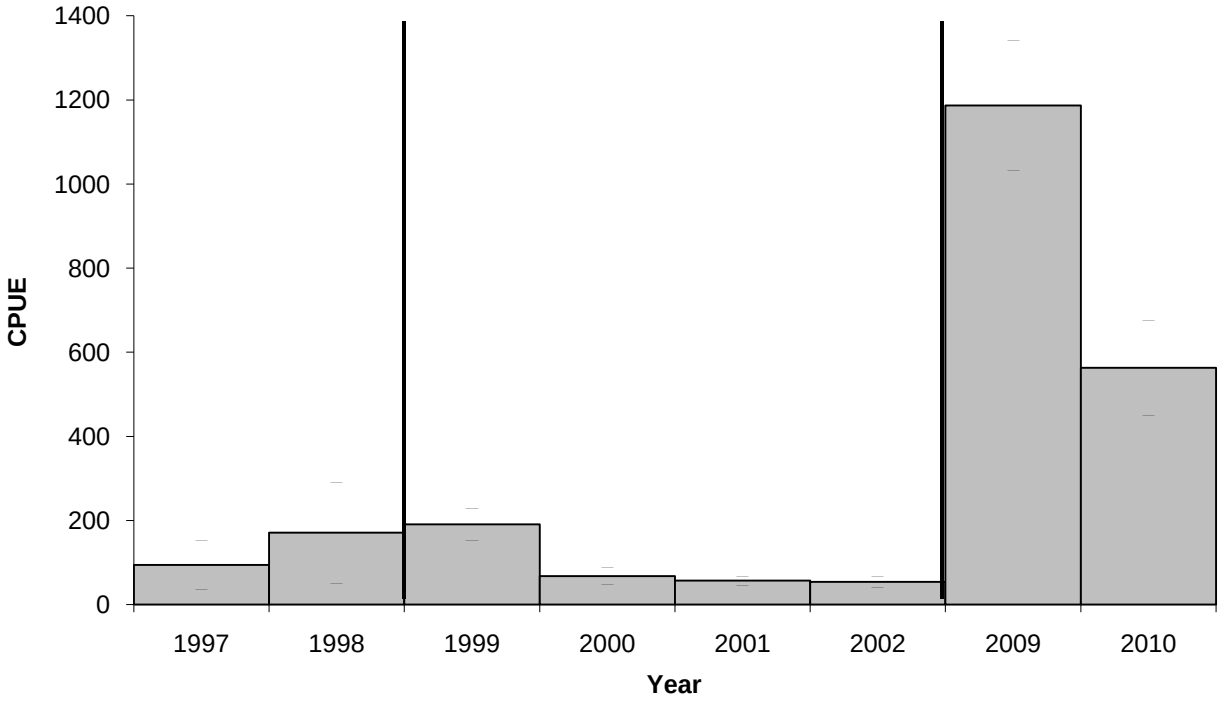
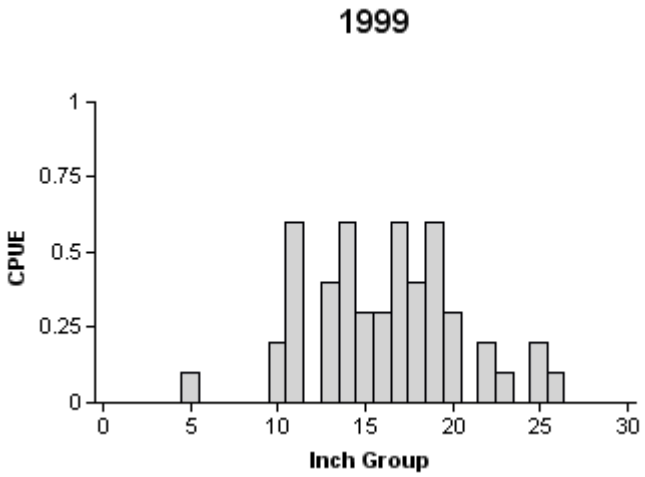
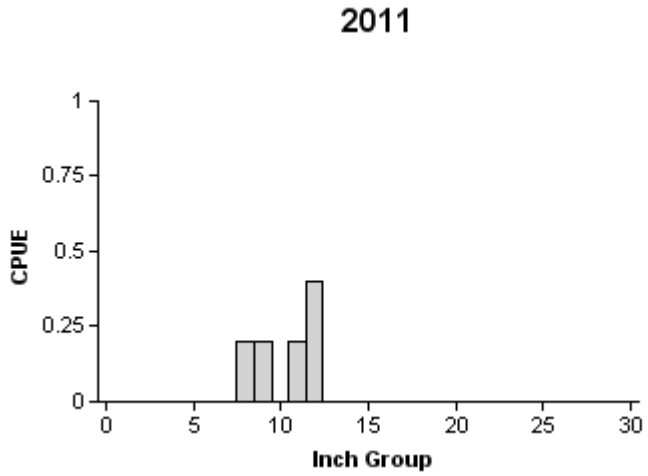


Figure 7. Number of bluegill caught per hour (CPUE) for fall electrofishing surveys, Sweetwater Reservoir, Texas, 1997-2010. Years within vertical lines represent drought period.

Channel Catfish



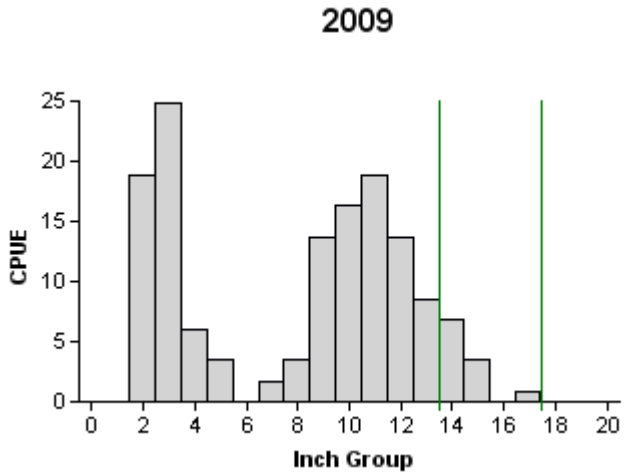
Effort = 10.0
Total CPUE = 5.0 (19; 50)
CPUE-12 = 4.1 (16; 41)
PSD = 60 (9)



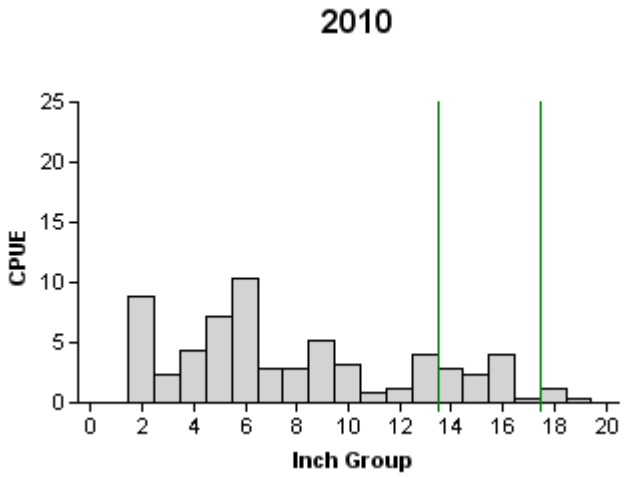
Effort = 5.0
Total CPUE = 1.0 (55; 5)
CPUE-12 = 0.4 (61; 2)
PSD = 0

Figure 8. Number of channel catfish caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for spring gill net surveys, Sweetwater Reservoir, Texas, 1999 and 2011.

Largemouth Bass



Effort =	1.2
Total CPUE =	140.6 (14; 164)
Stock CPUE =	85.7 (16; 100)
CPUE-14 =	11.1 (38; 13)
CPUE-18 =	0.0 (0; 0)
PSD =	39 (5)
PSD-14 =	13 (4)
PSD-18 =	0 (0)



Effort =	1.5
Total CPUE =	106.4 (16; 161)
Stock CPUE =	46.9 (16; 71)
CPUE-14 =	18.7 (27; 28)
CPUE-18 =	2.6 (45; 4)
PSD =	58 (8)
PSD-14 =	39 (6)
PSD-18 =	6 (2)

Figure 9. Number of largemouth bass caught per hour (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall electrofishing surveys, Sweetwater Reservoir, Texas, 2009 and 2010. Vertical lines represent lower and upper bound of slot limit.

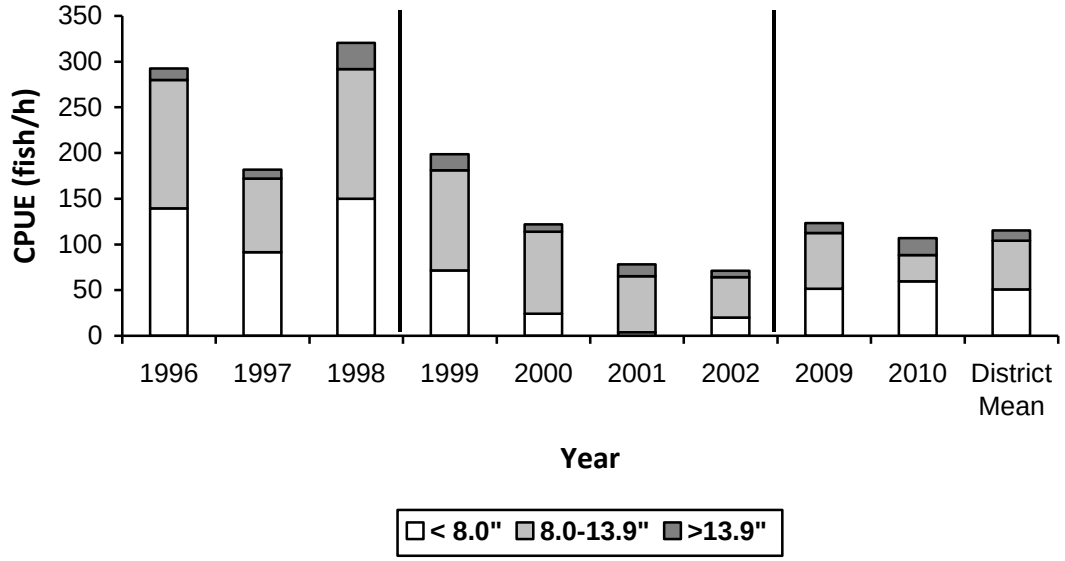


Figure 10. Electrofishing CPUE (fish/h) of largemouth bass less than 8.0" TL, 8.0-13.9" TL, and ≥ 14.0" TL from fall surveys, Sweetwater Reservoir, Texas, 1996-2010. Years within vertical lines represent drought period.

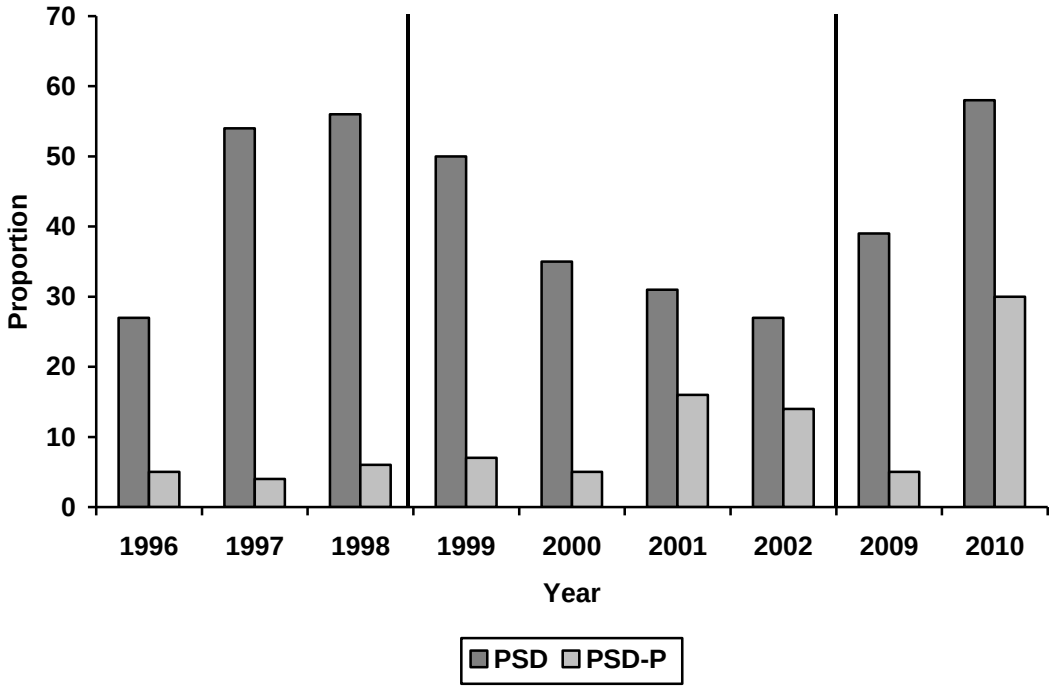


Figure 11. Proportional size distribution indices of largemouth bass from fall surveys, Sweetwater Reservoir, Texas, 1996-2010. Years within vertical lines represent drought period.

Table 4. Average relative weight of 8.0-11.9-inch and 12.0-14.9-inch, and ≥ 15-inch largemouth bass in 1996-1998 (pre-drought), 1999-2002 (drought), and 2009-2010 (post-drought) at Sweetwater Reservoir, Texas. The 95% confidence interval is in parentheses.

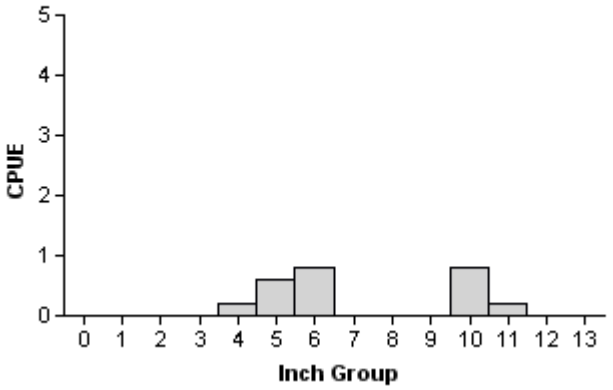
	Mean W_r /size category		
Year	8.0-11.9 in	12.0-14.9 in	≥ 15 in
1996-1998	92 (91 - 93)	88 (87 - 89)	95 (91 - 98)
1999-2002	92 (91 - 93)	88 (86 - 90)	101 (98 - 105)
2009-2010	89 (86 - 91)	96 (93 - 98)	102 (99 - 106)

Table 5. Results of genetic analysis of largemouth bass collected by fall electrofishing, Sweetwater Reservoir, Texas, 2009. FLMB = Florida largemouth bass, NLMB = Northern largemouth bass.

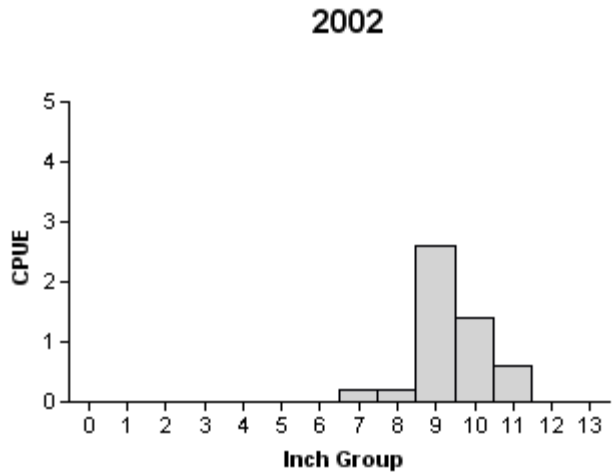
		Genotype				
Year	Sample size	FLMB	Intergrades	NLMB	% FLMB alleles	% FLMB genotype
1999*	40	1	22	17	24.0	2.5
2009	48	21	27	0	73.0	44.0

***** Genetics were determined with electrophoresis.

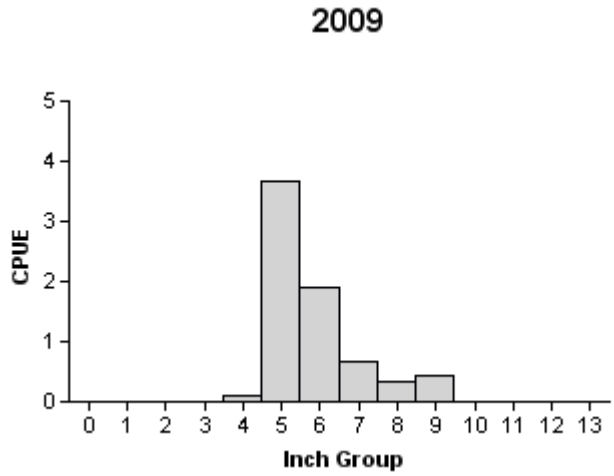
White Crappie



Effort =	5.0
Total CPUE =	2.6 (75; 13)
Stock CPUE =	2.4 (73; 12)
CPUE-10 =	1.0 (63; 5)
PSD =	42 (10)
PSD-10 =	42 (10)



Effort =	5.0
Total CPUE =	5.0 (54; 25)
Stock CPUE =	5.0 (54; 25)
CPUE-10 =	2.0 (47; 10)
PSD =	96 (3)
PSD-10 =	40 (12)



Effort =	9.0
Total CPUE =	7.1 (38; 64)
Stock CPUE =	7.0 (39; 63)
CPUE-10 =	0.0 (0; 0)
PSD =	11 (5)
PSD-10 =	0 (0)

Figure 12. Number of white crappie caught per net night (CPUE) and population indices (RSE and N for CPUE and SE for size structure are in parentheses) for fall trap net surveys, Sweetwater Reservoir, Texas, 1999, 2002, and 2009.

Table 6. Proposed sampling schedule for Sweetwater Reservoir, Texas. Gill netting surveys are conducted in the spring, while electrofishing and trap netting surveys are conducted in the fall. Standard surveys are denoted by S. Additional surveys are denoted by A.

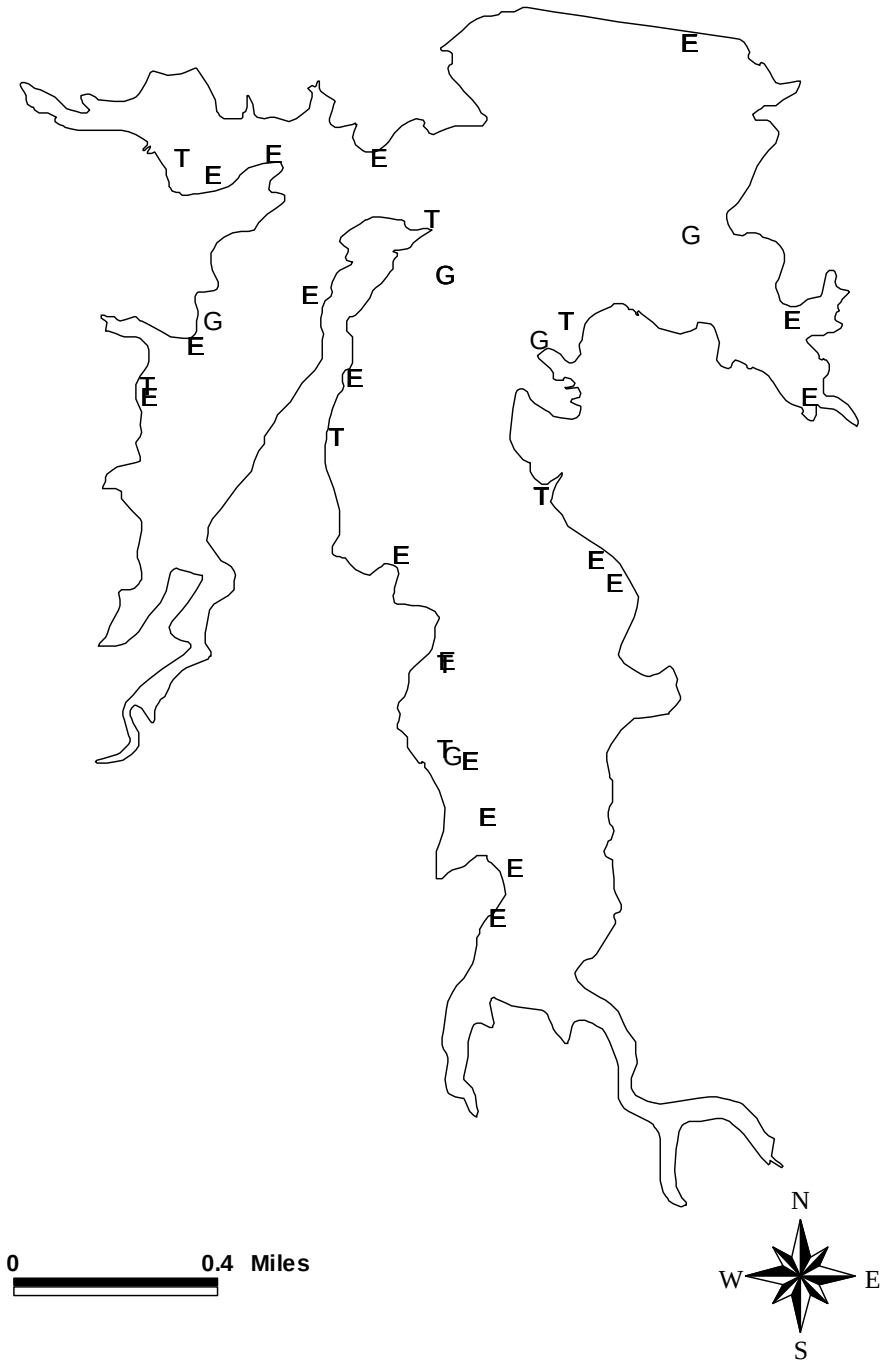
Survey Year	Electrofisher	Trap Net	Gill Net	Creel	Vegetation Survey	Access Survey	Report
Fall 2011-Spring 2012				A			
Fall 2012-Spring 2013	A	A					
Fall 2013-Spring 2014							
Fall 2014-Spring 2015	S	S	S		S	S	S

APPENDIX A

Number (N) and catch rate (CPUE) of all target species and presence of other species collected from Sweetwater Reservoir, Texas, 2010-2011.

Species	Gill Netting		Electrofishing		Trap Netting	
	N	CPUE	N	CPUE	N	CPUE
Gizzard shad	Present		572	572.0	Present	
Threadfin shad			15	15.0		
Golden shiner			Present			
Common carp	Present		Present		Present	
Inland silverside			Present			
Black bullhead	Present		Present		Present	
Channel catfish	5	1.0			Present	
Green sunfish			32	32.0		
Bluegill	Present		563	563.0		
Redear sunfish			1	1.0		
Largemouth bass	Present		161	106.4	Present	
White crappie	Present		Present		64	7.1

APPENDIX B



Location of sampling sites, Sweetwater Reservoir, Texas, 2010-2011. Gill net, trap net, and electrofishing stations are indicated by G, T, and E, respectively. Water level was 6 to 8 feet below conservation level at time of sampling in 2009-2011.

APPENDIX C

Type, location, size, capacity, American Disability Act (ADA) accessibility, and needed improvements of boat ramps (BR), fishing piers (FP), and jetties (J) at Sweetwater Reservoir, Texas, 2010. Latitude and Longitude are reported as decimal degrees.

Facility Type	Location	Latitude	Longitude	Fee	# of BR Lanes	BR Parking Capacity	Size of FP or J	ADA Accessible (FP or J)	Needed Improvements
BR	Dam	32.437541	-100.300439	Y	1	20	NA	NA	none